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the more difficult families. It is so valuable in so many ways that we wish it would be made available to a greater number of students. We venture to suggest to authors and publishers that they bring out an edition *without the illustrations*, and printed on thin paper, with narrow margins. A single volume, portable edition of this admirable book, would greatly extend its usefulness.—CHARLES E. BESSEY.

ZOOLOGY.

The Heart of Some Lungless Salamanders.[1]—The recent literature of zoology has, perhaps, contained nothing more unexpected and startling than that certain adult salamanders are entirely lacking in those respiratory organs which, heretofore, have been deemed indispensable to the existence of animals so high in the zoological scale as the Amphibia. This total lack of lungs and branchiæ appears the more marvelous when we remember that they are absent in forms which lead a rather active and wholly terrestrial life, as well as in those of more or less purely aquatic habits.

Two questions are naturally suggested by this apparently aberrant condition of the respiratory organs. First, what structures or organs have taken on the functions of the lungs and branchiæ? and secondly, is there any modification in the form or structure of the heart which in any way may be correlated with the above mentioned peculiarities of these lungless forms?

The first of these two questions has been discussed to some extent by Prof. Harris H. Wilder, of Smith College, who first published an account of this apparently anomalous condition. He concluded that respiration was probably carried on by the skin and, perhaps, to some extent, by the mucosa of the intestine. Prof. Camerano has also published the results of some experiments upon two European forms which bear upon this same question. He believes that in these lungless forms respiration is effected in the bucco-pharyngeal cavity, and that the skin affords no efficient aid in the respiratory processes.

In a still later paper he discusses the subject further, and tries to account for the disappearance of the lungs. Of one aquatic species (of the genus Molge) he says: "The function of the lungs as hydrostatic organs, is very marked." "In the clearly terrestrial forms one would say that the diminution in importance of the function of the lungs as hydrostatic organs induces a retrogressive development of them while at the same time the importance of the bucco-pharyngeal respiration is increased."

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[1] Read before the Amer. Assoc. Adv. Science, Aug. 24, 1896.

It appears to the writer that Camerano's conclusions need to be tested by further experiments, especially the part referring to the respiration, for the area of the dermal surface far exceeds that of the bucco-pharyngeal cavity, and the skin is also very richly supplied with blood vessels which are so close to the surface that it would appear as if the gases of the blood and air might be readily interchanged. It is hoped that time will permit of some experiments on this point during the coming year.

As to the second question, whether there is any appreciable modification of the heart in these lungless salamanders, nothing whatever has been published.

It is the object of this paper to call attention to the fact that there is a difference in the heart of those salamanders that do not have lungs and those which do have them. So far as I have examined, it is possible to distinguish between the two forms by examining the heart alone.

In order that what is said on this point may be clearly understood by every one, and in order to bring out the differences between the two more sharply, if possible, I wish first to recall to mind the structure of the Amphibian heart and then contrast with it the relations as found in the heart of a lungless individual. We may take Huxley's description of the Amphibian heart as our standard of comparison. In his Anatomy of Vertebrates he says: "The heart presents two auricles, a single ventricle and a bulbus arteriosus. A venous sinus, the walls of which are rhythmically contractile, receives the venous blood from the body and opens into the right auricle. The left auricle is much smaller than the right and a single pulmonary vein opens into it." In regard to the septum of the auricles, he says that "it is less complete in Proteus, Siren and Menobranchus (Necturus) than in other Amphibia. In Menobranchus the septum is reduced to little more than a wide meshed network of branched muscular bands, and in Proteus the existence of a septum is doubtful."

The heart of our common Newt (Diemyctylus viridescens) Fig. 1 or of the large yellow-spotted salamander (Amblystoma punctatum), for examples, corresponds perfectly with Huxley's description. In both of these forms the auricular septum is perfectly complete, the cavities of the auricles being entirely separated, except just at the auriculo-ventricular aperature, at which point the two auricles communicate with each other to some extent.

In Necturus, the septum is more or less fenestrated and, according to Huxley, it is very incomplete in Proteus and Siren, but in all of the

PLATE XVI.

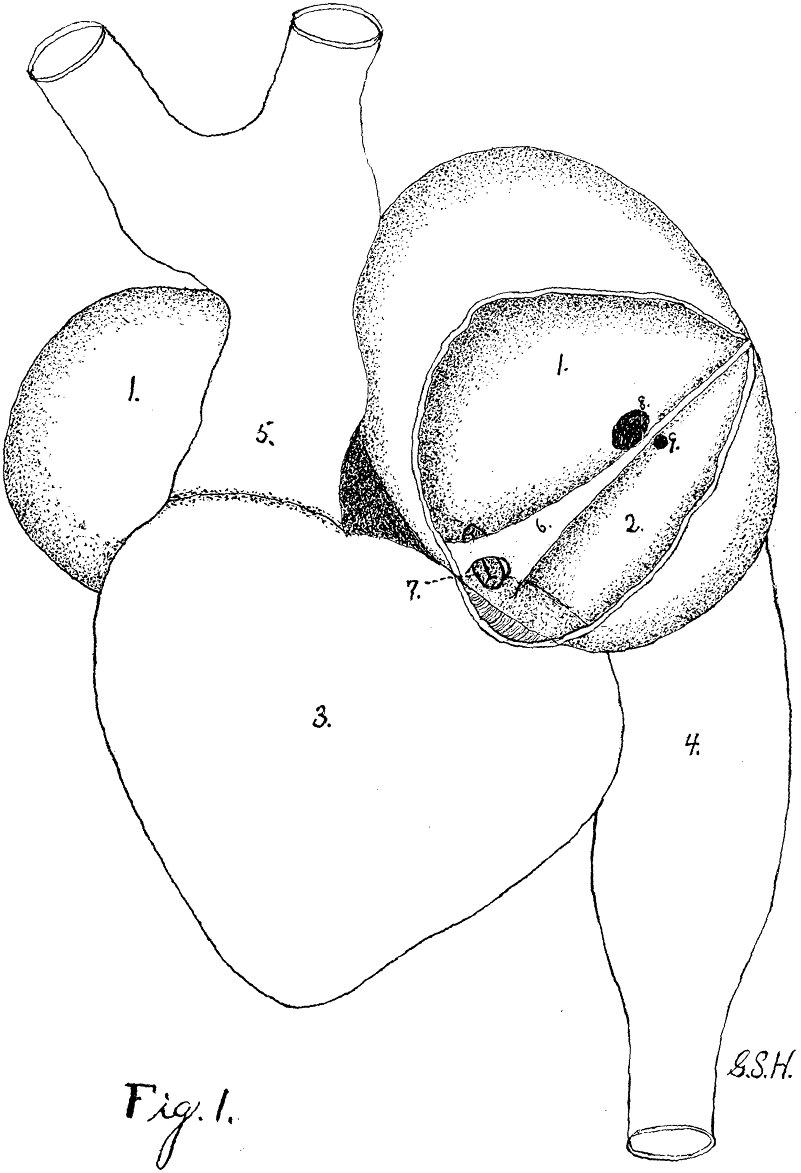

Fig. 1.

Hopkins on Diemyctylus.

PLATE XVII.

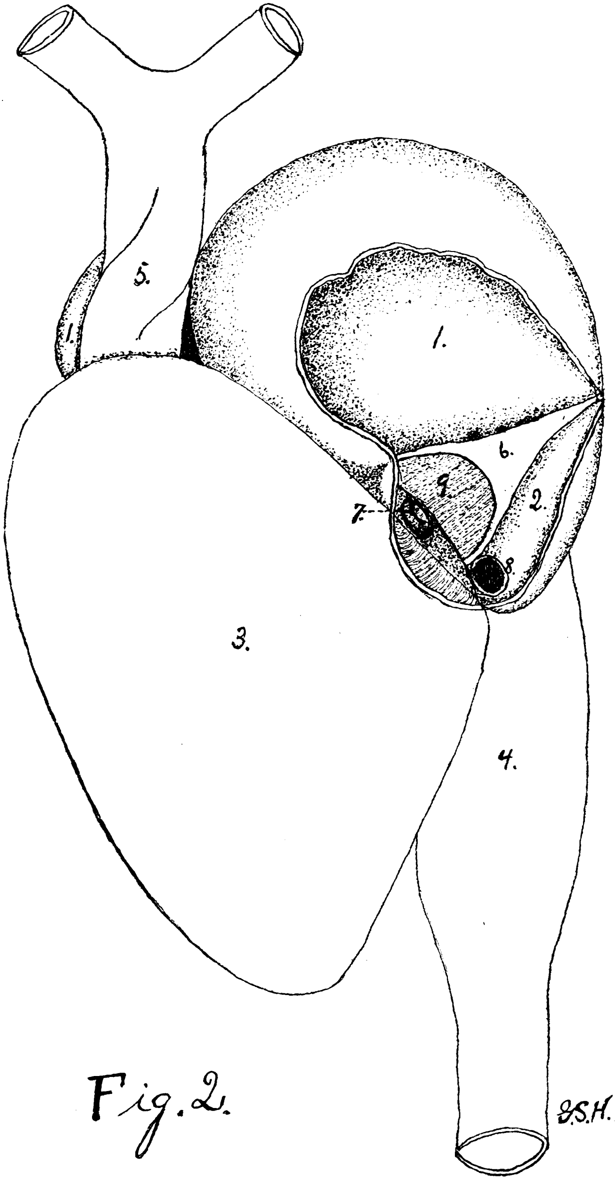

Fig. 2.

Hopkins on Desmognathus.

forms that have been mentioned, as well as in other members of the class Batrachia, the sinus venosus opens distinctly into the right auricle and the pulmonary vein into the left.

Let us now compare the heart of a lungless salamander (Fig. 2.) with the one just described. The four parts, auricles, ventricle, bulbus arteriosus and sinus venosus are clearly recognizable and, superficially examined, present nothing unusual; it is only when the cavities are opened that the differences between the two hearts become apparent. One of the first things to attract attention is the left auricle. In the lungless forms examined, it is much smaller in comparison to the right than in Diemyctylus, for example, and *no pulmonary vein was found opening into it.*

The auricular septum has only one opening through it, or perhaps, more correctly, it extends only part way across the cavity, but this aperture in the septum is so large (Fig. 2, 9.) that it is believed the communication between the two cavities is more free than even in Necturus. Just what function or functions the septum may have in these lungless forms, it seems to me, is not quite clear. That it has but little, if any use, is indicated by the way the sinus venosus opens into the auricles. In place of opening into the right auricle only, as in the forms having lungs, *it opens more freely into the left auricle than into the right.* If the ventral parietes of the heart be removed, one can look directly into the opening of the sinus venosus from either of the auricles, but more directly into it from the left than from the right, for when seen from the latter, one must look through the large opening of the auricular septum, Fig. 2, 9. In salamanders with lungs, each auricle opens in common into the ventricle with about equal freedom of communication, whereas in the lungless forms the right auricle is in more direct communication with the ventricle than is the left.

Judging from the above facts, i. e., the way the sinus venosus opens into the auricles, the freedom with which the auricles communicate with each other, and the way the auricles communicate with the ventricle, it would seem as if the heart of the lungless salamanders, functionally, was only bilocular in place of being trilocular as in the rest of the Amphibia. Morphologically, of course, it is trilocular, but whether it is so physiologically seems to me doubtful.

The heart of 8 lungless species have been examined by the writer, and so far as was made out, all of them agree closely with the description as given above. The probabilities are that in all the lungless forms similar conditions of the heart will be found. Up to the present time 17 species and sub-species, either wholly without lungs or with only functionless rudiments of them, have been reported. In his last paper, in which are enumerated 15 of the 17 lungless species, Wilder says that "in the Salamandridæ lungless species are as numerous as those possessing lungs, and that in consequence of this, the definition of the group must be modified." It seems, however, that even with his proposed additions, the definition is still not sufficiently comprehensive, for the peculiarities in the structure of the heart certainly have almost as profound a significance as the absence of the lungs themselves, and should be incorporated in any definition that may be given. In addition to the 17 lungless species already mentioned, the writer has found an additional one, *Spelerpes gluttolineatus.*

In order that one may see at a glance in which families and genera lungless individuals are found, the following table, taken from Prof. Cope's Batrachia of North America, is appended. [The last column is taken from the papers of Wilder and others].

Families.	Genera.	No. of species.	No. species without lungs or with only rudiments of them.
Cryptobranchidae	Cryptobranchus	2	
	Megalobatrachus	1	
Amblystomidae	Amblystoma	12 [N. A.] 1 [Siam]	1 A. opacum
	Chondrotus	7	
	Linguaelapsus	2	
	Dicamptodon	1	
Hynobiidae [all Asiatic]	Hynobius	5	
	Salamandrella	2	
	Onychodactylus	1	
	Ranidens	3	
	Batrachyperus	1	
Plethodontidae	Plethodon	8	2 P. cinerus P. erythronotus P. glutinosus
	Hemidactylium	1	
	Batrachoseps	4	1 B. attenuatus
	Stereochilus	1	
	Autodax	3	1 A. lugubris
	Geotriton	? [European]	1 G. fuscus
	Gyrinophilus	1	1 G. porphyriticus
	Manculus	2	1 M. quadridigitatus
	Spelerpes	9	3 S. bilineatus S. ruber S. gluttolineatus
	Oedipina		
	Oedipus	9	
Thoriidae	Thorius	1	1 O. variegatus
Desmognathidae	Desmognathus	3	1 D. fusca D. f. brimleyorum D. f. auriculatus

Families.	Genera.	No. of species.	No. species without lungs or with only rudiments of them.
Salamandridae [Old World]	Chioglossa	1	
	Salamandra	3	
	Hemisalamandra	1	
	Triturus	6	
	Pachytriton	1	
Pleurodelidae [All found in Old World; three species in N. A.]	Salamandrina	1	1 S. perspicillata
	Diemyctylus	10 [2 N. A. species]	
	Pleurodeles	1	
	Glossolega	3	
Amphiumidae	Amphiuma	1	
Coeciliidae	(numerous)	(numerous)	

In the last column of the above table, the figures indicate the number of species in which lungless individuals have been found. Where there is a discrepancy in the numerals and the number of species following them, it indicates either sub-species or species not mentioned in Cope's Batrachia of North America.

Description of Figures.

Fig. 1. Heart of Diemyctylus viridescens (semi-diagramatic) to show the general relations of the heart of a salamander with lungs. The ventral wall of the heart has been removed in order to show the auricular septum, the openings of the sinus venosus and the pulmonary vein, and also the relation of the auriculo-ventricular aperture to the right and left auricle.

1. Right auricle; 2. Left auricle; 3. Ventricle; 4. Sinus venosus; 5. Bulbus arteriosus; 6. Auricular septum; 7. Auriculo-ventricular aperture; 8. Aperture of sinus venosus; 9. Pulmonary vein.

Fig. 2. Heart of Desmognathus fusca (semi-diagramatic) to show relations of the heart in a lungless salamander. The ventral wall of the heart has been removed.

1. Right auricle; 2. Left auricle; 3. Ventricle; 4. Sinus venosus; 5. Bulbus arteriosus; 6. Auricular septum; 7. Auriculo-ventricular aperture; 8. Aperture of sinus venosus; 9. Opening through auricular septum.

G. S. Hopkins, D. Sc., Cornell Univ.

On two new Species of Lizards from Southern California. —Anota calidiarum Cope.—A single lateral fringe of conic scales, extending on three-quarters the length between the axilla and groin;

no trace of inferior fringe. Enlarged lateral gular scales only traceable below the rictus oris. Occipital horns moderate, each with a short accessory horn at the external base; internal temporal horn half as long as the occipital, with a short accessory horn at the external base; external temporal horn very short, and the temporal anterior to it presenting a serrate edge only. Infralabials presenting a serrate edge only; parietal region bounded on each side by an angulated border which overhangs the temporal region.

Squamation of the head smaller than in other species; superior labials twelve, below the middle of the eye, instead of eight or nine in *A. platyrhina* the nearest allied species. Seven subequal scales in the transverse row between the canthal rows on the frontal angle; there are five unequal scales on the corresponding position in the *A. platyrhina.* Six longitudinal rows of supraocular scales, of which a group of five or six posterior to the middle are larger, but unequal. Supraorbital rows in contact, except at points, on the median line; last superciliary presenting a sharp angle; penultimate also presenting a prominent angle. Tomia of mouth only moderately serrate; a row of conic scales rising posteriorly on the side of the neck, and above its posterior end an inconspicuous rosette. A conspicuous rosette above the middle of the humerus.

This species is nearest to the *A. platyrhina* Gir. from which it differs in various respects. The general proportions of all the parts and the coloration are about as in that species, the difference chiefly appearing in the squamation and the horns. The scales of the head are much more subdivided, and the presence of accessory horns is unique in the genus. The simplicity of the lateral fringe is also characteristic, as is also the rudimental character of the rosette on the neck.

Anota calidiarum Cope.

Catal. No.	Ariz. No.	No. species	Locality.	Source.	Obs.
8444	434	1	Death Valley, Cal.	U. S. Agric. Dept.	Alcoholic.

I may add here that in my estimation the genus Anota Hallow. is valid. It includes the species *A. modesta* Gir., *A. goodei* Stjen., *A. platyrhina* Gir., *A. maccallii* Hallow., and the above described.

SCELOPORUS VANDENBURGIANUS Cope.—This is a small species with small scales and very dark colors. There is not much difference in the sizes of the dorsal, lateral and ventral scales; forty-five rows may be counted between the occiput and a line connecting the groins, and twelve in a head length. Between the groin and axilla thirty-five scales may be counted to an axillary area of smaller and smooth scales. The dorsal and lateral scales are keeled and mucronate; those of the inferior surfaces smooth and mostly feebly notched. Caudal scales strongly keeled and mucronate and larger than dorsals. Two parietals on each side, the anterior the larger, and extending to the narrow marginal supraocular row, so that there is only one frontoparietal on each side. A third parietal external to the other two. The frontal is not longitudinally divided. There is one series of six large supraoculars, separated from the frontals and frontoparietals all round by a series of small scales. External to the large supraoculars is a series of four much smaller polygonal flat scales much as in *S. biseriatus.* Between these and the superciliaries one row of still smaller scales (with an extra scale or two); two scales on the canthus rostralis. Head scales all smooth; six large free auricular scales. A single vertical prehumeral fold enclosing a pocket of granular scales; temporal scales keeled. The extended hind leg reaches to the auricular meatus. Temporal pores sixteen; male with postanal plates.

Color of adult male dark green above, with faint traces of a paler stripe on each side of the back, and of a few darker spots on each side of the middle line. Inferior surface dark blue, with a pale line in the middle of the abdomen. Femur spotted with blue below; tibia and tail light greenish below.

Measurements.

	MM.
Total length,	127
Length to vent,	57
Length to line of axilla,	22
Length to line of interparietal plate,	13
Length of hind leg,	38
Length of hind foot,	18
Length of fore leg,	23
Length of fore foot,	10

Sceloporus vandenburgianus Cope.

Catal. No.	No. spec.	Locality.	Donor.	Obs.
21931	1	Summit of Coast Range, San Diego Co., Cal.	Dr. E. A. Mearns.	Alcoholic.

I have seen of this species only one specimen, which is an adult male. The colors of the female may be expected to be somewhat lighter. I have dedicated it to Mr. Jno. Van Denburgh, of San Francisco, an able writer on herpetological subjects.—E. D. COPE.

Modification of the Brain during Growth.[2]—1. One of the most marked changes of the embryo brain is the formation of the great bend near its middle, giving rise to the cephalic fexure. The cause of the bend is unknown. After it is formed, the early appearance of optic fibers and those of the postcommissure and supracommissure tends to produce a comparatively fixed portion at this bend as shown by measurements of parts of the brain in soft shelled turtle and the cat. The later developing parts produce secondary changes in the form of the brain tube as the embryo takes on the specific characters of the adult.

2. The pons bend of embryo mammals is a feature of the brain of many non-mammalian embryos which do not possess a pons, and in specimens examined is associated with and seems to be due to the early and enormous development of the Gasserian ganglion and its union with the brain by the fifth nerve. Later these parts are overshadowed by the growth of other parts and the pons bend becomes obscure.

3. In the cat the pons bend is exaggerated by the formation of a great fist shaped mass of cells at the surface on each side of the meson. This mass of cells is continuous with a conspicuous layer of cells which extends upon the surface to the union of the solid wall of the oblongata with the membranous roof or tela. This layer and cell mass seem to be proliferations such as His and Herrick have described as occurring at the union of a solid wall with a membrane. Later these cells are covered by pons fibers.

4. In the soft shelled turtle and the cat, early stages show clearly that the prosotela, the membrane included by the edges of the rima in the cerebrum, is a continuation of the membranous roof of the diencephal, such that if the brain were plastic the continuation of each side could be brought to occupy the dorsal surface of its cerebrum. A condition would thus occur which is comparable with the actual condition found by Wilder in Ceratodus. It may be of value in the further determination of homologies between the brain of fishes and mammals, as in fishes the membranous roof of cerebrum and diencephal is continuous.

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[2] Abstract of paper read before the Amer. Asso. Adv. Sci., Aug. 24, 1896.

5. The dorsal (sensory) and ventral (motor) zones of His, demarcated by a sulcus extending from the myel through the brain to the optic recess, have not been verified in the forms examined (cat, turtle, amphibia, bird). The indications are rather that an original segmented condition is partially disguised by a secondary formation of sulci which extend in a cephalo-caudal direction. None of the five such sulci found in the oblongata could be said to separate the sensory from the motor region. The dorsal and ventral of them demarcate raphés. One of them occurs *in* the sensory, two *in* the motor, but there is no dividing sulcus between the two regions. The extreme point to which any of them could be traced was in the region of the albicans, none of them reaching the porta or the optic recess. A second group of sulci arising in the optic and preoptic recesses extend to the porta, two of them passing through the porta to form the boundary of the striatum.

SUSANNA PHELPS GAGE.

The Lion of India.—The report that *Uncia leo* is found at the present time in the environs of Guzerate and Kutch appears to be an error. It has probably never existed in the latter locality, and is now to be met with only in the forest of Gir in the Kathiawar. It has disappeared from Rajkot, where it was abundant in 1832, from the hills of Bardo, and from many other localities where it formerly existed in great numbers, nor has it been seen for a long time in the forest above mentioned. Formerly hunters very seldom ventured in that region for fear of the bandits who were in the habit of taking refuge there, and also for fear of contracting fever. Gradually, however, the forest is being cleared away, settlements are being made, and the domain of the lion is being curtailed. To prevent total extinction of the species, the Durbar of Kathiawar has forbidden lion hunts for a period of six years. But this will do no good unless at the same time a forest reservation is made.

The popular belief that this species is without a mane in India is another error that is corrected. (Revue Scientif. Août, 1896).

Inheritance of Artificial Mutilations.—The instance cited by Mr. Norman E. Hills (in the September Naturalist) of the birth of short-tailed fox terriors, is striking in showing a larger proportion of deformed puppies than is common in such cases, but instances like the one cited are frequently noted in the press devoted to dogs, and concerning several breeds that have been mutilated for generations.

But to thoroughly consider the matter of the inheritance of artificial deformities, the cases of breeds in which the deformity is usually natural, should be considered. I believe the tailless Manx cats generally come in that shape, and this I know is often the case with the bobtail sheep-dog of England, and this is stated of several breeds of dogs, generally of the type of the bobtail sheep-dog found in other countries, Norway, Southern Russia and elsewhere.

But the peculiar feature of this inheritance is its freakishness. Two naturally long-tailed parents have produced a tailless dog, in whom the potency was so strong that no bitch, no matter what the breed was, ever produced a full, natural tailed puppy to him. I remember of one puppy by this dog, ex his double grandam (he was the son of litter brother and sister) whose tail was of usual length, but had a deformity in it as though it were tied in a knot. Again, it is not at all uncommon for a bitch to begin production with all naturally long-tailed puppies, and after some years, change to always producing some tailless ones, even when mated with mongrel dogs, while some bitches reverse the order, beginning with tailless ones and changing to full-tailed ones. I recently noted a reported instance of just such a change of production in a Manx cat, and it seems to me that this freakishness introduces a very disturbing element into consideration of the question of inheritance.

As an allied matter, please permit me to say that the notion that if a bitch has a mongrel litter she will thereafter *always* produce puppies showing traces of the unallied sire, is rank rubbish, and on the point that this occurrence is *not* invariable, any experienced breeder will concur, as very, very few such breeders have ever seen such a case. For myself, I have bred dogs for over forty years, have bred many mongrel litters, and never saw a case of telegony—or, as we commonly call it, "influence of previous sire." That this influence does sometimes show itself, is beyond doubt; but some very extended inquiries of mine some years since, showed that it was shown only in about one per cent. of cases of mesaliances; and when it was considered that an instance of this "influence" will be remembered from its extraordinary character, while instances where it does not occur are forgotten, being the expected result, I believe that the one-tenth of one per cent. of cases will be found to be the extent of its occurrence. It is very strange that those scientific men who uphold the idea of the invariable occurrence of this "influence," all overlook the potent fact that the "influence" shows itself invariably only in the skin and hair, never affecting conformation. In view of this, the theory propounded by Dr. Jonathan Hutchinson, President Royal College of Surgeons; Dr. J. Sidney Turner, President South British Medical Society, and Everett Millais, Esq., seems sound, and bears against the idea of the bitch being herself bastardized, that theory being that unripe ova are partially impregnated by the spermatozoa of the foreign male, not sufficiently to fully vivify them, the influence of this impregnation affecting only the epiblast, from which the skin is evolved, and a subsequent fertilization brings full life to the ova, determining other features of the fœtus. Thus, in the case of a pug bitch, which had a mongrel litter by a Skye terrier, and at her subsequent whelping by a pug dog, had some puppies with rough hair, these "influenced" puppies had the conformation of the pug all over, even to the twisted tail.

However, be the scientific part of the question what it may, the too common idea that a bitch having a mongrel litter will show influence of that litter in all future offspring, is utterly fallacious.

Yours truly, W. WADE.

Oakmont, Pa., Sept. 14, 1896.

ENTOMOLOGY.[1]

A New Character in the Colobognatha, with Drawings of Siphonotus.—In all known Diplopoda the external seminal apertures are located just behind the second pair of legs or in the coxæ of the second legs. In all Diplopoda except Polyxenus one or more pairs of legs are more or less modified to assist in copulation. In a great majority of forms the legs most modified are those of the seventh segment, but in two groups, the Omniscomorpha and Limacomorpha of Pocock the legs of the seventh segment are unmodified, while one or more pairs at the caudal extremity of the body are transformed into copulatory organs. The modification which has taken place in the Limacomorpha is very slight, for according to Mr. Pocock's descriptions and figures the last legs of *Glomeridesmus marmoreus*[2] consist of four or five joints and differ from the others mostly in being shortened and thickened. An equal or greater degree of specialization is now known to exist in other legs than those of the seventh segment, indeed, an almost equal peculiarity of structure is sometimes manifested by nearly all the male legs of certain genera of Polydesmidæ, Spirostreptidæ and Spirobolidæ. Especially noteworthy are the first pair of legs in Iulidæ, Parajulidæ and Pæromopodidæ; the second pair of legs of Stemmatoiulidæ and Parajulidæ; the third pair in Striariidæ. With-

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[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

[2] Journ. Linn. Soc. Zool., XXIV, 475.